

Name:

Solutions

1. Convert the exponential equation $b^x = a$ to a logarithmic equation.

$$\log_b a = x$$

2. Convert the exponential equation $9^3 = 729$ to a logarithmic equation.

$$\log_9 729 = 3$$

3. Convert the exponential equation $e^k = v$ to a logarithmic equation.

$$\log_e v = k \quad \text{or} \quad \ln v = k$$

4. Convert the logarithmic equation $\log(20) \approx 1.3010$ to an exponential equation.

$$10^{1.3010} \approx 20$$

5. Convert the logarithmic equation $\log_4 32 = \frac{5}{2}$ to an exponential equation.

$$4^{\frac{5}{2}} = 32$$

6. Convert the logarithmic equation $\ln(e^3) = 3$ to an exponential equation.

$$e^3 = e^3$$

7. $\log_{10} 1000 = 3$

$$8. \log_{17} 1 = 0$$

$$9. \log_5 \frac{1}{5} = -1$$

$$10. \log(-10) = \text{undefined}$$

$$11. \log_2 32 = 5$$

$$12. \log_{27} 3 = \frac{1}{3}$$

$$13. \log_2 \frac{1}{8} = -3$$

$$14. \log_7 \sqrt{7} = \frac{1}{2}$$

$$15. \log_{16} 64 = \frac{3}{2}$$

$$16. \log_9 0 = \text{undefined}$$

$$17. \log_a a = 1$$

$$18. \log_b b^7 = 7$$

$$19. \log_{16} 8 = \frac{3}{4}$$

$$20. \text{Expand } \log_5(25x) = \log_5 25 + \log_5 x = 2 + \log_5 x$$

$$21. \text{Expand } \log_6\left(\frac{36}{y}\right) = \log_6 36 - \log_6 y = 2 - \log_6 y$$

$$22. \text{Expand } \log(k \cdot p)^3 = 3 \log(k \cdot p) = 3 \log k + 3 \log p$$

$$23. \text{Expand } \log(y^2 \sqrt{x}) = \log y^2 + \log \sqrt{x} = 2 \log y + \frac{1}{2} \log x$$

24. Condense $\log w + \log m = \log(wm)$

25. Condense $\log_x a - \log_x b = \log_x\left(\frac{a}{b}\right)$

26. Condense $2\log_2 a - 3\log_2 b = \log_2 a^2 - \log_2 b^3 = \log_2\left(\frac{a^2}{b^3}\right)$

27. Condense $\log x + \log y - \log z = \log(xy) - \log z = \log\left(\frac{xy}{z}\right)$

28. Evaluate $\log_6 2 + \log_6 18 = \log_6(2 \cdot 18) = \log_6 36 = 2$

29. Evaluate $\log_4 128 - \log_4 2 = \log_4\left(\frac{128}{2}\right) = \log_4 64 = 3$

30. Evaluate $\log_{10} 4 + \log_{10} 250 = \log_{10}(4 \cdot 250) = \log_{10} 1000 = 3$

31. Evaluate $\log(10^6) = 6$

32. Evaluate $\ln(e^5) = 5$

33. Solve $125^x = 5$ without logs and without a calculator

$$5^{3x} = 5^1 \quad 3x = 1 \quad x = \frac{1}{3} \quad \left\{ \frac{1}{3} \right\}$$

34. Solve $9^x = 27$ without logs and without a calculator

$$3^{2x} = 3^3 \quad 2x = 3 \quad x = \frac{3}{2} \quad \left\{ \frac{3}{2} \right\}$$

35. Solve $16^x = 8$ without logs and without a calculator

$$2^{4x} = 2^3 \quad 4x = 3 \quad x = \frac{3}{4} \quad \left\{ \frac{3}{4} \right\}$$

36. Solve without logs and without a calculator $25^{x-1} = 125^{2-x}$

$$\begin{aligned} 5^{2(x-1)} &= 5^{3(2-x)} \\ 2x-2 &= 6-3x \\ 5x-2 &= 6 \end{aligned} \quad \begin{aligned} 5x &= 8 \\ x &= \frac{8}{5} \end{aligned} \quad \left\{ \frac{8}{5} \right\}$$

37. Solve without logs and without a calculator $8^{3-x} = 16^{x-2}$

$$\begin{aligned} 2^{3(3-x)} &= 2^{4(x-2)} \\ 9-3x &= 4x-8 \\ 9 &= 7x-8 \\ 17 &= 7x \\ \frac{17}{7} &= x \end{aligned} \quad \left\{ \frac{17}{7} \right\}$$

38. Solve with logs and with a calculator $4^x = 10$

$$\begin{aligned} \log 4^x &= \log 10 \\ x \log 4 &= \log 10 \\ x &= \frac{\log 10}{\log 4} \\ x &\approx 1.6610 \end{aligned} \quad \left\{ 1.6610 \right\}$$

39. Solve with logs and with a calculator $e^x = 9$

note:
 $\ln e = 1$

$$\begin{aligned} \ln e^x &= \ln 9 \\ x \ln e &= \ln 9 \\ x &= \ln 9 \\ x &\approx 2.1972 \end{aligned} \quad \left\{ 2.1972 \right\}$$